The Role of Community Based Institution for Climate Change Adaptation Mechanisms in Choke Mountain, East Gojjam, Ethiopia

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Abstract

Community based institutions play significant role for community livelihood buildings in a given community. This research had attempted to examine how community based institution(s) initiated watershed development project has a significant impact for the development of climate change adaptation mechanisms, and livelihood improvements. The main purpose of this study was to identify the role of community based institution for the development of adaptation mechanisms and its determinants. The key finding of the research showed that community based organization could play a significant role for the development of adaptation mechanisms. When performing their role it has some gaps in the process of implementation such as lack of participatory decision making process, targeting problem to address the poor, the young and the women; weak stakeholder linkage, some conflicts over communal livelihood resources and lack of the development of social capital. The research has concluded that the project could play a significant role to implement adaptation mechanism with some gaps. Then to fill the gap and go along with the sustainability of the project, the findings recommended frequent negotiation and lobby from the concerned stakeholders is needed. These all solve the conflict, and hence enhance better adaptation mechanisms.

Key words: Adaption mechanism, climate change, community-based institution

1. Introduction

In recent years, environment has become a key issue in Ethiopia. It has also fragile highland ecosystems that are currently under stress. This is because of the presence of irregularities and volatilities of the climatic trends, which make low level of economic development and poor access to basic services. Ethiopia is highly dependent on rain fed agriculture where there is poor institutional, environmental and resource based knowledge. The implication of climate risk on different sectors including agriculture, water resource, health and energy is great (NAPA, 2007).

Most parts of Ethiopia in general and the Amhara Regional State in particular is characterized by mountainous agriculture with slope gradients ranging from 5-45%. In addition to this, much of the annual rainfall comes in short violent events of up to 100 mm/day, this exposure of denuded slope areas to these types of rainfall results in Ethiopia having one of the most serious soil degradation problems in the world. Annual rates of soil loss in the Amahara region in some steep lands and overgrazed slopes exceed 300 tons/ha/year, or 250 mm/year. Nationally, on over 2 million hectares, the soil depth is so reduced that the land is no longer able to support cultivation (ANRS, 2000).

Ambaber watershed is found in the Choke watershed and it has deteriorated from a surplus producing to a food deficit area within a span of 20 years with more and more land being abandoned and/or productivity declining to levels below that could maintain even mere subsistence. To combat this, more than 20 community based institutions are established (Belay and Shibru, 2007). This research was designed to examine the role of community based watershed development project for climate change adaptation mechanisms and to determine the factors that affect adaptation mechanism.

2. Materials and Methods

2.1 Description of the study area

The study site, Choke Mountain Watershed, is located approximately between coordinate 10033'06" to 10050'24" North latitude and 37042'36" to 37058'24" East longitude. Topographically, the watershed lies in the altitudes range of 3000 to 4413 m.a.s.l. The macro watershed is found entirely in Eastern Gojjam Zone of six Woredas such as; Bibugne, Debay Tilatgin, Gozamen, Hulet Eju Enssie, Machakel, and Senan (Bewket, 2010).

The specific site of Ambaber is found in Shemie Kbele, Debay Tilatgin woreda at distance of 350 km North West of Addis Ababa and 60 km east from Dbere Markos, which is the zonal capital of the woreda. The altitude of the Kebele ranges from 3000 to 4000 meter above sea level. The main purposes of the CBO are for natural resources development and to enhance tourism marketing, which was established in 2007. The total land area of the watershed in the Kebele is estimated to be 900ha with total household of 590 of which 500 are males and the rest of 90 are females, and the remaining 747 households are not members of the CBOs (Shemie Kebele, 2011). The total household of the Kebele is equal to 1337(CSA, 2008).

2.2 Research approaches and design

Qualitative data that are required to describe and understand the role of community based organization for climate change adaptation mechanisms and associated constraints which hinder the process were used. Quantitative was also used for dealing with explanatory and descriptive type of data to make hypothetical-deductive analysis among variables

2.3 Method(s) of data collection and analysis

The data collection methods used to address the research objectives were household survey, Focus Group Discussion (FGD), Key Informant Interview (KII), observation, and document review. This study pursues a kind of comparative analysis among CBO members and non-members of the sample households. Descriptive statistics and measures of statistical significance like independent and paired sample t test, one way ANOVA, bivariate correlation, and binary logistic regression were used. The variables were hypothesized to influence adaptation mechanisms, which can be positive or negative. Following Gujarati (2003), the model is specified as:

$$\text{Log (y)} = \text{In (P/ (1-P))} = \alpha + \beta_1 x_2 + \beta_2 x_2 + \ldots + \beta_{11} X_{11} + e$$

Where:

P = Probability and *Y = outcome of interest which can be affected by* | *X*1 = *x*1, X2 = *x*2

$$Y = \frac{e\,\alpha + \beta 1x1 + \beta 2x2}{1 + e\,\alpha + \beta 1x1 + \beta 2x2}$$

Where variables and hypotheses

X1= Age of house hold head (-) X2 = gender (+/-)

X3 = Family size (+) X4 = educational level (+)

X5= Land size (+) X6= Number of oxen (+)

X7= wealth status (+) X8= CBO membership (+)

3. Results and Discussion

3.1 Role of community based institution(s) (on) climate change and adaptation mechanisms

Climate change and adaptation mechanisms implemented by the CBI

The major climate change adaptation mechanisms that the community based institution/CBI had been carrying out since its introduction, are many. These include soil conservation, compost preparation, afforestation, preventing deforestation, area closure and management, water management, cut and carry system, conserving and promoting of high yield and disease resistance local crop varieties, conserving indigenous forest species , awareness rising to conserve natural resources, promoting fuel stove dissemination, and preparing hay from communal grazing system. Furthermore, maximizing new opportunities have been implemented as climate change adaptation mechanisms such as growing new crops (peas and beans), having new animals that were not before in this site (example goat), and adoption of other new technologies.

Different researchers as cited in IFAD (2009) stated that the above mechanisms are practices of climate change adaptation mechanisms and they recommend there have to be implementation by developmental stakeholders (IPCC, 2001; IPCC 2007b; IPCC, 2007; IUCN, 2009; Agrawal, 2008; Kurukulasuriya and Mendelssohn, 2008).

Table 1: Respondents on main climate change adaptation mechanism implementation status

Implemented activities	Responses	Frequency	Percent	Implemented activities	Responses	Frequency	Percent
Plant community (wood lot)	Yes	39	40.6	Participate in community forest protection	yes	55	57.3
	No	57	59.4		no	41	42.7
	Total	96	100		total	96	100
Prepare compost	Yes	57	59.4	Participate in area closure management	yes	54	56.3
	No	39	40.6		no	42	43.7
	Total	96	100		total	96	100
Implement soil conservation	Yes	61	63.5	Participate in water resource development	yes	53	55.2
	No	35	36.5		no	43	44.8
	Total	96	100		total	96	100
Participate in rehabilitation of degraded lands	Yes	53	55.2	Practice rotational grazing system	yes	59	61.5
	No	43	44.8		no	37	38.5
	Total	96	100		total	96	100
Participate in managing range lands	Yes	55	57.3	Implement a forestation	yes	52	54.2
	No	41	42.7		no	44	45.8
	Total	96	100		total	96	100
Implement cut and carry system	Yes	56	58.3	Multiply and use local high yield crop	yes	54	56.2
	No	40	41.7		no	42	43.8
	Yes	50	52.1		total	96	100

Source: own survey 2011

Next, it had been compared to [1] project performance status of the local communities between community based watershed development members and non-members. It was examined by using descriptive statistics and independent sample "t" test. Most of the CBO members, above 80% of the respondents, described that they implemented the entire above mentioned project activities individually. However, there were only less than 35% of non-member respondents implemented most activities.

The other tool, an independent sample 't' test of the mean performance difference between members and non-members, validates this fact and it had a significant mean difference for implementation of all activities performance p=0.000-0.001(t=3-18.13, df =94) which proves a significant application difference between communities based watered development project members and non members. This is because the project target groups more internalize resource conservation techniques so that key resources of the area become in good position, due to the intervention. Azmeraw (2010) found the same results what is demonstrated here and EPA (2006) document had also similar investigation with this finding.

From the focus group discussions, the following major points came out that are almost consistent with the survey results of the present study. The participants explained that they have been rehabilitated with the same biophysical activities. The biophysical activities were using indigenous local species such as "Koso" (*Hygenia abyssinica*), "Asta" (*Erica arborea*), "Enjori" (*Morus mesozygia*), "Gemey" (*Hypericum revelutum*) and other bush and grass species plants. Additionally, plantation of new species trees were developed such as; high land Bamboo (*Arundinaria alpina*), "Nech bahirzaf" (*Euclptus globulesis*), "Key bahirzaf" (*Euclptus cameldulesis*), "Tid" (*Junipers procera*). These all reforestation, plantation, and rehabilitation have been practicing in 20 hectares degraded areas with area closure.

1. Choke mountain Rehabilitation Project by Community based organization that plays a role for the development of proper climate change adaptation mechanisms

Similarly, other 25 hectares communal grazing land were properly managed and used to feed their animals on rotational basis. Apple plantation, compost preparation, feeding their animals using cut and carry system, multiplying and distributing local important varieties mainly white barley, black *temeze, and Senef kollo* barley on individual basis have been promoted to revive them. Lime application was also implemented to reduce the acidity of soils. From the triangulation, it can be generalized that there is a strong project performance by the community-based institution than non-member groups.

The secondary data obtained from the project annual report of the woreda supports the above justification. About 9.5 ha soil bund and 1900 m^3 compost have been constructed and prepared. About 15600 seedlings have been planted which, includes "Koso", Junipers, Eucalyptus and Bamboo. "Black *senef kolo*" on 2.4ha, black barely on 0.8 ha, white barely on 11.5ha have been multiplied and grown by the farmers. For rotational grazing 25.5 ha pasture has been delineated and 0.25 ha gully rehabilitated. Moreover, about 8.33 and 20 hectares of community wood lot plantation and forest area closure were rehabilitated and maintained, respectively, for the eco system (WARDO, 2011). The documents reviewed at woreda level have also indicated similar figures observed at the kebele level (Ambaber CBO, 2011). These and other related activities were supposed to be accomplished by CBO as explained in the project document designed by Belay and Shibru, (2007). According to the findings of the present study the proposed activities were partly implemented by CBO.

Project gaps

In addition to achieving the above objectives and activities, the institution has expected to play some roles that contributed to the improvement of local people livelihoods. These roles include accessing communal natural resources with better service, empowering the community, promoting participatory decision making, and equal commitment for all, encouraging collective action, which includes participatory plan and adopting inclusive rules and regulations in the project site (Belay and Shibru, 2007). Nonetheless, as expressed from focus group discussants, these activities in the process also face some gaps in practice. These include lack of targeting for women and youth, weak institutional linkage and information exchange, lack of collective action plan, lack of developing inclusive rule for the disadvantageous community. Furthermore, there are also lacks of skill to coordinate and mobilize the community for further joint action; lack of

participatory decision-making and community empowerment to manage and own the project are some among others. Even if participation difference existed between CBO members and non-members in natural resource management and conservation, the extent of participation in decision making to decide on administrative and institutional issues have been still low. Most of the respondents explain these all are existing problems and will exist in the process of this research project implementation too.

Even if the by-laws of the CBO indicates there is General Assembly Meeting three times on a year basis to evaluate their performance , this has not been made still in this study year as confirmed by the CBO focus group discussion. The non-members of CBO respondents stated that as long as these gaps are existed, we don't want to be members of the CBO.

Similar findings were expressed in the Adaba- Dodola participatory forest management project of the Oromia region that lack of sufficient number of professionals with participatory forest management background, organizational aspects, conflict resolution techniques, and benefit sharing scheme were some of the prevailing constraints in the execution of participatory forest management approach (Tsegaye, 2004). The project document (Belay, 2007) expects the implementation of the above activities; however, these vital issues still did not achieved.

3.2 Factors affecting adaptation mechanisms

In this section, the research tries to address how different community groups develop adaptation mechanisms. Among the different age categories, youngsters whose ages are between 18-30 were interviewed. They responded that they did not implement most of the activities mentioned above or they did not participate in communal resources management and conservation. Most of the youngster respondents also declared that they did not implement or participate to develop adaptation mechanisms. However, the adult respondents whose age was from 31-60 attested that they implemented or participated in the development of the above-mentioned adaptation mechanisms. Furthermore, those of elders whose age was above 60 approved their implementation or participation was low.

While it is shifted to the performance difference between male and female respondents, the majority of the female respondents approved, they did not implement the above climate change adaptation mechanisms. Subsequently, what happened between CBO members and non-

members was discussed. In most activities, the CBO member group respondents indicated that they implemented or participated in the implementation process of climate change adaptation mechanism. These activities were by far greater than the non-member respondents. Activity implementation of wealth category for climate change adaptation mechanisms also investigated. Their performances coincide with the previous argument. The fact shows that the poor respondents verified that they have not implemented those activities or are implementing them with low (scale). On the other hand, the medium and better wealthy respondents performed better than others did.

For graphic demonstration, the value of the average implementation is calculated based on the value of 1= implement the activities 0= do not implement the activities. All these are summarized by the pie chart as follows.

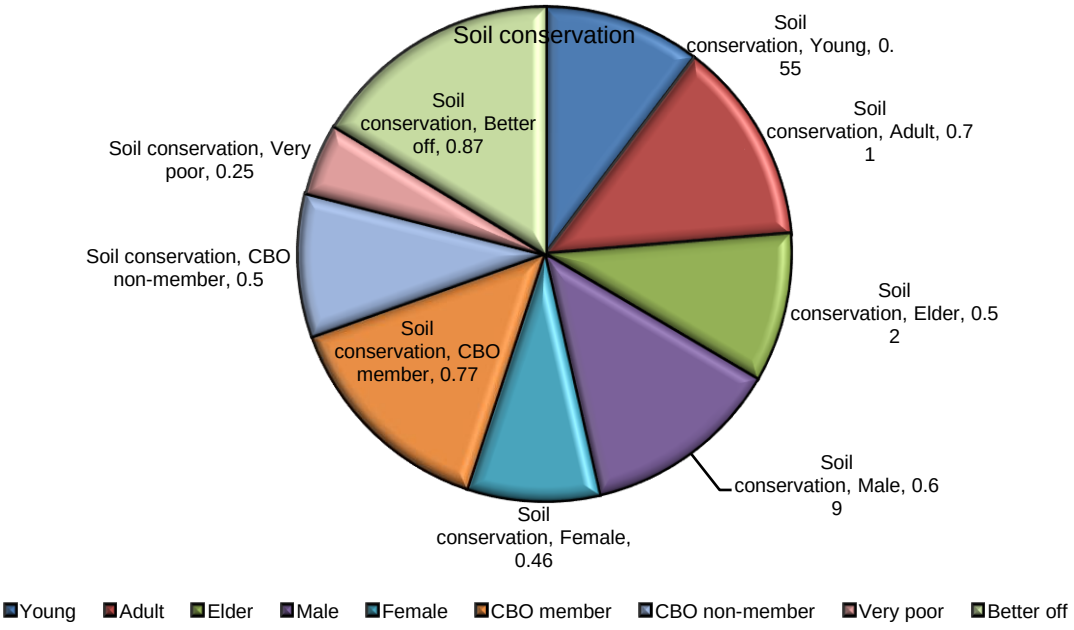

Figure 1: Average adaptation mechanism implemented by different groups of the community

Source: *Own field survey, 2011*

Before going to the determinant factors affecting farmers to implement climate adaptation mechanism, it is better to discuss whether the main climate change adaptation mechanisms of the local communities have a relation (with them) or not. These are: - soil conservation, compost preparation, afforestation, forest protection, area closure management, water development, cut

and carry system, rotational grazing, disease resistance and high yield crop conservation, and using fuel saving stove , have correlation with independent variables such as based on age, sex, wealth and CBO members and non-members, family size, land size, oxen number and educational level. These all are analyzed using bivariate correlation analysis tools. The bivariate correlation of sex indicates r-value ranges = 0.4- 0.7 with p value of 0.000-0.003, for the CBO category r=0.4-0.73 at p value of 0.000-004. The bivariate correlation for family size, land size and number of oxen r=0.25-0.3, 0.2-0.44 and 0.2-0.4 with p value of 0.001-0.013, 0.000-0.007, and 0.000-0.049, respectively. However the r value for educational status significant for only compost preparation p=0.026 and r=0.23, for soil conservation p=0.045 and r=0.2, for participation of degraded land rehabilitation and range land management p=0.03 and 0.004 with r=0.22 and 0.3, sequentially. This implies the independent variable, sex, CBO membership, wealth status, family size, land size, and oxen number have a relation with the implementation of the above adaptation mechanisms and educational level for the four selected items mentioned above.

Development of adaptation mechanism by gender and CBO membership

Gender differential in response to climate change and taking adaptation measures have also been investigated. The implementation status of the above-mentioned dependent variable by gender shows there is a significance difference between the two groups. The independent t. test also has indicated the P value, which is equal to 0.000 (t=4.3-9.4, df =94) for all the above mentioned variables which has an implication of a great significance mean difference between the two groups.

Data from the focus discussion also draws various reasons for low implementation status of adaptation mechanisms. Especially the two female group discussions justify, they do not have the exposure to exercise such activities as most of their time was confined with home management, and childcare. Furthermore, even if they have the knowledge to such measures, they do not have the power to decide to implement such activities due to cultural bound. This implies that in Ethiopian context, most farming activities are implemented by male groups and these groups have better exposure for (adaptation mechanisms). Therefore, the implementation of adaptation mechanism activities are more associated with males than females.

Likewise, gender analysis between CBO members and non-members show there is a significance difference between the two groups with the exception of fertilizer application. In fertilizer application there is no significance difference between the two groups, however, slightly CBO non-members use more fertilizer than member groups, since non-members did not practice more in compost utilization or CBO members develop more inclination for organic agriculture than using fertilizer. Therefore, the independent t-test p value ranges from p= 0.000-0.015(t=2.48-5.98, df=94) for all the above mentioned dependent variables except fertilizer application. This implies that there is a significant difference between the two groups in implementation of adaptation mechanisms. The implementation signifies that CBO members implement or participate in the implementation of adaptation mechanisms more than non-members participate with a meaningful difference. This implies that community based institution play a vital role in the development of climate change adaption mechanisms, since members of this institution have better adaptation performance than non-members groups do.

Similar findings were investigated in other point of Choke mountain water shed development site. It indicates the existences of significant difference in the implementation of conservation mechanisms between members of the CBO and non-member together with significance difference between male-headed farmers with female-headed farmers (Azmeraw, 2010).

Development of adaptation mechanism by wealth status and age groups

The analysis of the implementation of the adaptation mechanisms by different wealth groups indicated that there is significant difference among the wealth groups. It has been proved that most types of adaptation mechanisms were well implemented by the better off wealth categories. The statistical analysis (one-way ANOVA) supports these arguments and it lies between p=0.000-0.003 (F=4.8-15.1, df=3) for all performances. In addition, the post hock analysis of most activities showed that there were significance differences between the very poor and medium, very poor and better off, poor and medium, poor and better off wealth groups. However, no significance difference was recognized between the consecutive category divisions between poor and very poor, medium and better off wealth groups. This indicates that the mentioned adaptation mechanisms were more implemented by the wealthiest groups than the poor and very poor with large proportion difference.

On the other hand the analysis results (one-way ANOVA) based on age groups indicated significance difference only for some adaptation implementation mechanisms that include compost preparation (p=0.043, F=3.2), cut and carry system (p=0.046, F=3.2), and fertilizer application (p=0.43, F=3.3) with degree of freedom (2) for all analysis. Accordingly, the post hock analysis indicated that there were significance differences between the adult and elder groups. However, there were no significance differences between the youngest and the adult groups. The reasons for these were that adults and young have enough labor power to do such adaptation mechanisms compared to the elders. Even if significance difference is observed only for some of the local adaptation mechanisms, the adaptation mechanism implementations have inverse relation with age groups due to shortage of labor force when the age increases. This implies that labor force plays a determinant role for the response of climate change adaptation mechanisms rather than experiences. The labor force availability is the determinate factor that affects the community to take such measures that influence the implementation abilities and capabilities.

Development of adaptation mechanism by land size and oxen number

The analysis (one-way ANOVA) results indicated that large land size contributed for the implementation of adaptation mechanisms (p=0.000-0.035, F=2.7--8.3) at degree of freedom (df=4). Further the post hock multiple group comparison analysis indicated that having no land and having land size between 3.1-5 *timad*, having less than one *timad* and having land size between 3.1-5 *timad*, no land and having land size between 5.1-7 *timad*, having less than one *timad* and having land size between 5.1-7 *timad* have significant difference. However, there is no significant difference between the consecutive land holding sizes. These all indicates that there was significant difference between the extremes land holding sizes. The analysis leads to conclude that land holding sizes have a great contribution for the implementation of adaptation mechanism.

The oxen size on the other hand was significant only for some dependent variables like preparation of compost, participation in community forest protection, water development activities, rangeland management activities, and rehabilitation of degraded lands. Generally, it can be concluded that people that have more oxen number practice and participate in the implementation of adaptation mechanisms than those with no/or less oxen number.

Determinants of climate change and adaptation mechanisms

The area's main climate change adaptation mechanisms such as afforestaion, area closure management, changing of sowing/planting date, compost preparation, soil conservation, multiplication and use of high yield local varieties, cut and carry system, rehabilitation of degraded lands, forest protection, fuel saving stove utilization, rotational grazing and water development were regressed using binary logistic regression. These dependent variables are analyzed against independent variables such as age, education level, sex, wealth, CBO member ship, family size, land size, and number of oxen.

Implementing afforestation in the area by CBO membership and wealth category are explained by 77% and 80% at p value of 0.001 and 0.000, respectively. This implies that implementing afforestation has greatly explained by the CBO members and wealthiest category. It confirms that the independent t test and ANOVAs test showed significant difference exist within each category. Implementing and managing of areal closure, what was observed and predicted also explained by 83% at p= 0.000 for both CBO members and wealth category division. However, changing planting date contradicts the above trend and in all categories p>0.05 shows insignificant difference among the independent variables mentioned. This indicates that this adaptation mechanism was implemented by all categories without a significant difference. Concerning the preparation of compost, it is expressed by 83.3% for CBO members p=0.000 and wealthiest category at p value of 0.023. The soil conservation implementation observed and predicted values were expressed by 80% with CBO membership, p= 0.003 and wealth categories p, value of 0.000. Conserving and promoting high yield local crop varieties are expressed by 75% with p value of 0.000 for CBO membership categories. Practicing cut and carry system was also expressed by 86.5 % for CBO membership with p =0.000 and for wealth categories p =0.008. At the same time, participation in rehabilitation of degraded lands was expressed by 88% with p value of 0.000 for wealthy categories. Implementing utilization of fuel saving stove was also expressed by 83% for wealth categories. Practicing and implementing of rotational grazing, and water development for different purposes were shown by 70% and 84% at P= 0.000 and 0.001 for CBO membership and wealth categories, respectively.

Harmonizing all these arguments the determinant factors that hinder or contribute for the implementation of main adaptation mechanisms are described as follows. As expressed by t test,

and one way ANOVAs and there is a significant difference of implementing adaptation mechanisms between male and female, among age groups, different oxen size groups, different land size holding groups, among wealth categories, between CBO members and non members. But the regression result of observed and predicted values shows that the implementation of main climate change adaptation mechanisms were highly interlinked with CBO membership and wealth categories. Thus, it is concluded that the foremost determinant factors for the implementation of climate change adaptation mechanism were being a CBO member and better in wealth status. The next factors that hinder its implementation were it did not target the disadvantageous groups such as females and elders, low land size and oxen holding, weak information exchange, lack of credit and agricultural extension service.

Moreover, the data found from the focus group discussions and key informants go parallel with what was described by the quantitative data. The focus group discussion raised a few issues of the obstacles for both implementing project activities and climate adaptation mechanisms. It was demonstrated that the existence of conflict between the watershed development kebele(s) communities and its neighbourhood's four other kebeles. Due to this conflict, the two sites of the project were not functional during this study. In addition to computing communal resources, there was no clear boundary between the project site and neighbouring kebeles. Besides, according to their explanation, due to the intervention of the project, communal resources (forest and grazing lands) have been observed in better condition than the other kebeles. Accordingly, the discussion with people in other kebeles claimed to consume these resources by saying cow and honey bee have not clear demarcation to consume whatever they want and the Choke is commented to all and the CBO members do not agree on nonmembers idea, for this reason the conflict continues. Watershed conservation community based institutions at kebele, woreda, and zonal levels did not give recognition for their role and the implementation of adaptation mechanisms were other critical points.

The pervious findings also support these facts (IPCC 2001; NAPA, 2007; Agrawal, 2008). Similar findings were found in the participation of conservation practices that had age has inverse relation to take conservation measure. CBO members could practice more awareness and develop more conservation practices than non-members develop, women participation in those practices was low, and there is significance difference between male and female household

heads: which means those of males has developed more conservation mechanisms than females. Even if family size and education contributed positively towards development of conservation mechanisms, there is no significance difference between relatively large land holding size and higher education level (Azmeraw, 2010). These all leads to reach at a conclusion that community based institution(s) can play a vital role for the development of climate change adaptation mechanisms though there were still some gaps in organization management process.

4. Conclusion

Based on the overall investigation, Community Based Development Institution(s) could play a role to achieve climate change adaptation activities that support the local communities' livelihood, such as; area closures, rotational grazing, cut and carry system, liming, preparation of compost, multiplication and distribution of farmers' important local varieties, and forestation and forest protection. These have enabled the achievement of conservation of biodiversity at the local level, reducing deforestation, improved land productivity, reduction of soil erosion, promotion of water development, enhancement of organic agriculture, and increment of the resilience capacity of ecosystem and economic returns. Nevertheless, the study demonstrated that the project has some gaps in the process of implementation. These includes the project did not target at the disadvantaged part of the community, especially youngsters, females and very poor segments of the communities. The determinant factors that have contributed against or towards implementation of adaptation mechanisms were CBO membership and non-membership, and wealth difference categories. Those had better off and CBO members have performed better than the other group with significant difference. Next to these two factors, others are differences in age group where the adults have been performed more. Gender (males have become more implementer than females); Lack of institutional linkage and support, lack of recognition for the implementation of those activities, and existence of internal and external conflicts. To overcome these gaps, concerned bodies (Regional, Zonal, Woreda and Keble Agriculture office; Regional, Zonal ,Woreda and Keble Environmental protection office, Regional, Zonal ,Woreda and Keble Administrative office; Regional, Zonal ,Woreda and Keble cooperative organization and promotion office) and the larger community shall work together and develop ground rules that enhance development and environmental protection. By minimizing these gaps, this project shall

scale up these good practices to other similar areas to promote climate change and adaptation mechanism(s).

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